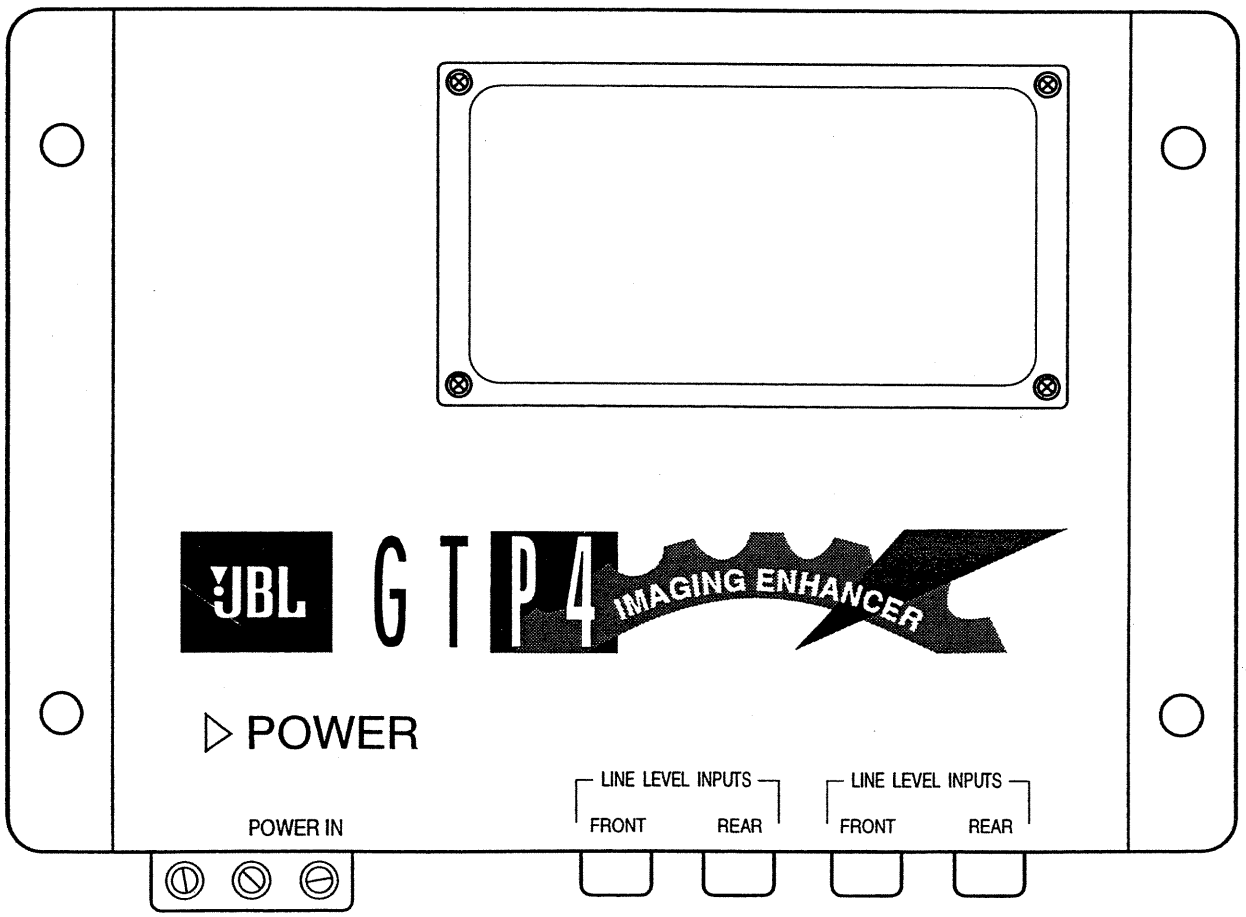
GTP4
IMAGING
ENHANCER
TECHNICAL MANUAL



JBL Consumer Products Inc.
80 Crossways Park West
Woodbury, N.Y. 11797
1-800-336-4JBL in the USA

A Harman International Company

Part No.: GTP4SM Rev A

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GTP4

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GTP4 Specifications

Signal to Noise Ratio:	100 dBA
Frequency Response:	20 Hz - 20k Hz (±0.1 dB)
THD:	0.04%
Maximum Line Level Input Voltage:	4V RMS
Maximum Speaker Level Input:	7V RMS
Input Impedance:	20kΩ
Output Impedance:	250Ω
Speaker Level Intput Impedance:	15Ω
Power Requirement	11 to 16 VDC negative ground
Fuse Size:	3 AMP "ATC" Type Automotive Fuse
Size: Main Unit: 5-7/8" x 7" x 1-2/8" (inches. L x W x H).	(149mm x 178mm x 38mm)
Size: Remote Control Box: (inches. L x W x H).	3.25" x 3.3" x 1.18" (83mm x 84mm x 30mm)

Theory of Operation

The JBL GTP4 is an analog signal processor which is designed to recreate a realistic sound stage and center image without the need for adding a tough to install center channel speaker. This virtual center image is created through a JBL proprietary techology (patent pending). The GTP4 also includes the capability to extract ambient information from the recordings which can help to recreate the live feel in music. The JBL GTP4 is composed of four sections, the virtual center image circuitry (engaged in driver mode), the front ambience recovery circuitry, the rear ambience recovery circuitry, and the switching circuitry.

The virtual center image circuitry manipulates the amplitude and phase (time delay) of the front left and right channels when in the driver mode. IC2-2 and IC3-1 form a network which alters the phase and frequency response of the left speaker output to compensate for the fact that the person seated in the driver seat is closer and more off axis to the left speaker than the right speaker. This circuitry combines with the gain circuitry on the right channel located in IC3-2 to create the virtual center image circuitry.

The front ambience recovery is created by cross coupling circuitry located in IC2-1 and IC2-4 and the associated circuitry. The amount of ambience recovery that is mixed back in with the modified (driver mode) or unmodified (all mode) stereo signal is controlled by the optocoupler and the voltage at pin 4 on the remote control which is adjusted by the front ambient control knob. Ambience recovery is on in both the "All" and "Driver" modes.

The rear ambience recovery circuitry is a pure L-R surround circuit. IC3-4 in combination with optocoupler D2 control the output level of the left and right rear channels. The level is determined by the voltage on pin 6 of the remote connector which varies according to the setting on the rear ambience control knob.

Mode and bypass switching on the GTP4 is accomplished through the use of 4066 CMOS switches (IC5, IC6 and IC4) which are controlled by switch positions on the wired remote.

Audio Connections

The signal voltage levels and impedances of the inputs of the GTP4 are compatible with virtually all signal sources that feature preamp (line) and speaker level outputs.

Preamp Level Connections

Connect the audio input and output RCA connectors as shown in the diagram on page 3. The connections to and from the GTP4 should be made with high quality shielded cables terminated with standard RCA connectors. These cables should be kept as short as possible to minimize the chance of noise pick up. Never attempt to splice together shielded wires.

Speaker Level Inputs

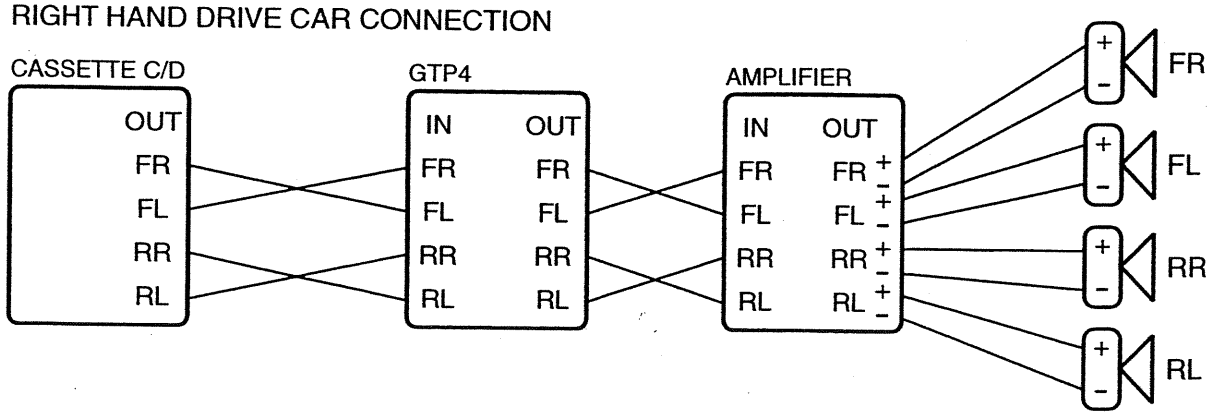
When the high level (speaker level) outputs of a cassette/CD are used to drive the GTP4, the signal enters through a special 8 wire harness and connector (included). If extension wires must be used to connect the speaker output from the cassette/CD player to the GTP4 high (speaker) level inputs use 18 gauge speaker wire. Keep such extension wires as short as is practical and do not run them outside the passenger and trunk compartments. Use the color code of the input wire harness and the cassette/CD player output wires to be sure the left/right channel orientation and the positive/negative orientation, of each connection is correct. For example, the left positive output of the cassette/CD player must be connected to the left positive input of the GTP4. The color code for the high level input wire harness is:

Left Front +	White
Left Front -	White/Black
Right Front +	Gray
Right Front -	Gray/Black
Left Rear +	Green
Left Rear -	Green/Black
Right Rear +	Purple
Right Rear -	Purple/Black

Refer to "System Connections Diagram and System Configuration Diagram" for more information.

After finishing the audio connections double check that all connections are Left In to Left Out and Right In to Right Out (Right hand drive car must cross these wires as shown in the diagram below). Correct phase and L/R wiring is crucial for proper operation of the Imaging Enhancer.

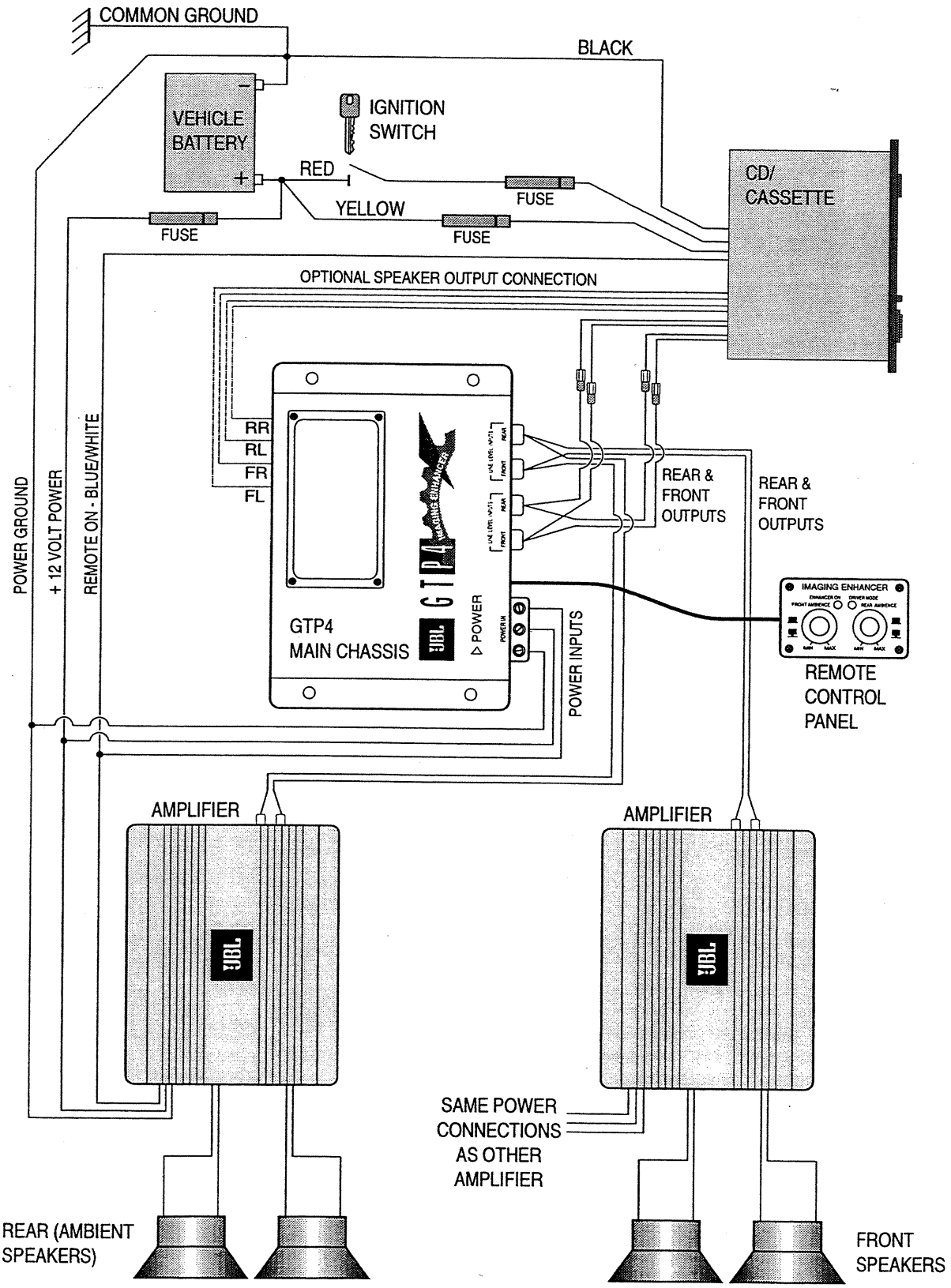
RIGHT HAND DRIVE CAR CONNECTION



Power Supply Connections

Battery (+) Terminal - Connect to a + 12 Volt, 3 Ampere power supply.
Ground - Connect to the power supply negative terminal.
Rem Terminal - Apply +12 volts to this terminal to turn on the GTP4. The power LED will light when the GPT4 is running.

System Connection Diagram



GTP4 Controls and Connectors

1. Remote Control Connector
Connector for wired remote control.

2. Car Size Optimizer Switch
This switch is located under the plastic access panel. The switch optimizes and centers the imaging for either large or standard size cars. The switch should normally be set to standard but can be adjusted by listening and selecting the switch option which positions vocal imaging at the center of the dash.

3. Power LED Indicator
This indicator lights when the unit is powered up and operational.

4. Power Connector
Connect the Battery +, Ground and CD/Cassette Remote on/off line to this connector.

5. Fuse
3 amp ATC type fuse.

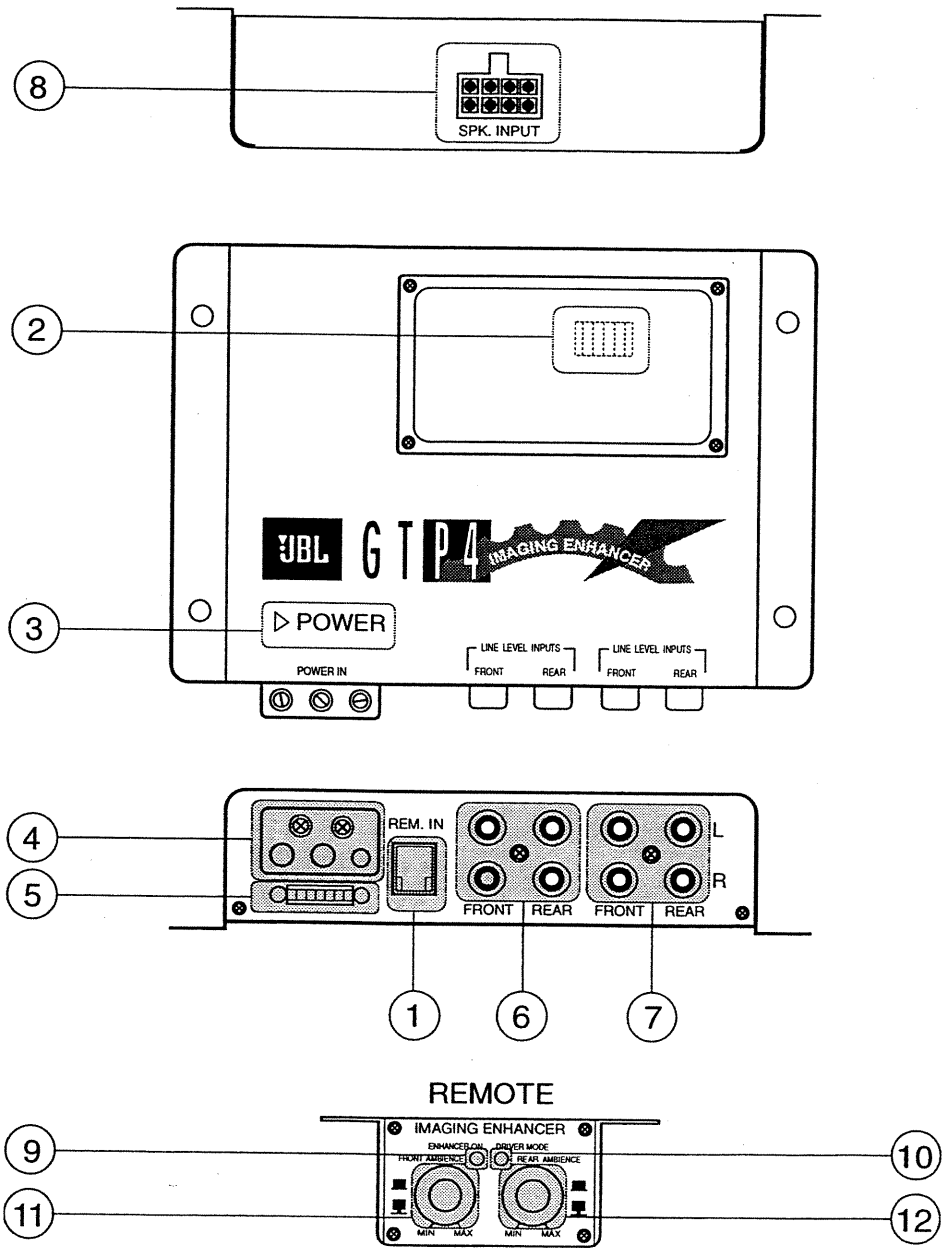
6. Line Level Input RCA Connectors

7. Output RCA Connectors

8. Speaker Input Connector
Input which can accept speaker level connections from CD/cassette players that do not have line level outputs.

9. Remote Bypass/On Indicator
This indicator is on when the GTP4 processors is engaged and off when the GTP4 is bypassed.

10. Driver/All Optimizer Indicator
This indicator is on when the GTP4 is in "Driver" optimization mode and off when the GTP4 is in "All" passenger mode.



11. Front Amience and On/Bypass Control and Switch
Rotating this control adjusts the amount of ambience and front staging width produced by the GPT4. Pulling the knob places the GTP4 in "Bypass" mode. Pushing in the knob places the GTP4 in "On" mode.

12. Rear Ambience and Driver/All Optimizer Control
Rotating this knob controls the amount of rear fill ambience and the "room size" of the acoustic environment when used in a system with rear speakers. Pulling the knob out places the GTP4 in "All" optimization mode. Best results at the driver position will be achieved with the control in the "Driver" setting.

Operation and Setup

Note: Since the GTP4 is primarily designed to optimize the sound stage for the driver, all tests should be performed while sitting in the driver's seat or closer to the left speaker.

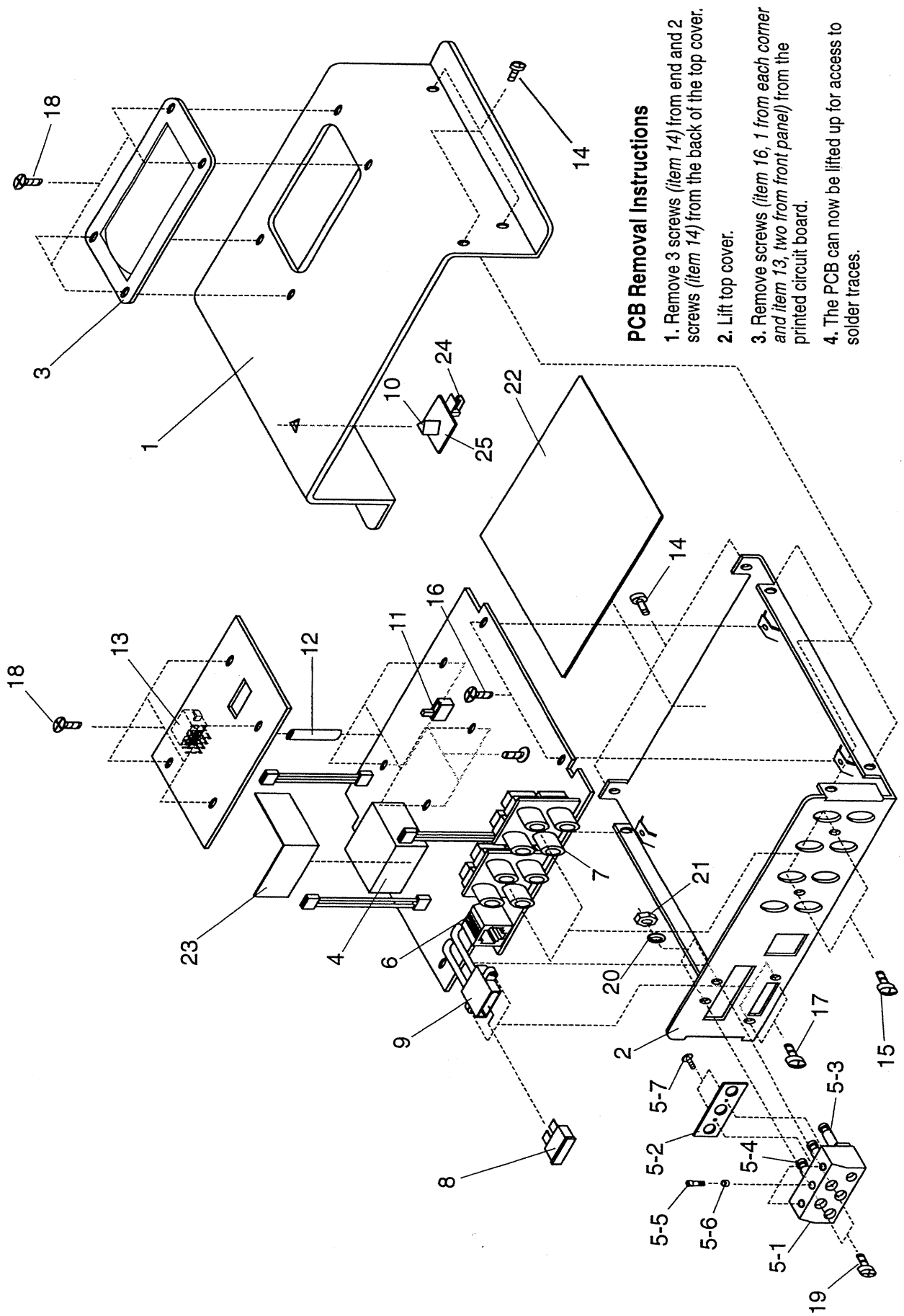
1. The Power Indicator LED on the GTP4 main chassis should light up when the head unit is turned on.
2. Make sure the "Front-ambience - Bypass/On" knob and "Rear-ambience - Driver/All" knobs are pushed in and rotated completely counterclockwise.
3. Play a selection which has vocals and good 'center' channel information.
4. Gently turn up the volume to a comfortable listening level. You should hear a very distinctive center image coming from the middle of your dashboard. If not, make sure the "Rear ambience - Driver/All" knob is pushed in to the "Driver" position for driver optimized sound stage.
5. Proceed to push and pull the rear ambience knob to hear the effects of "Driver" and "All" modes. You should hear imaging coming from the middle of the dashboard when the knob is pushed in (Driver mode). You should hear stereo with ambience recovery when the knob is pulled out (All mode). If you find that the center imaging in the "Driver" position is slightly offset to the left or right side of the dashboard, there is a two position adjustable switch inside the main unit which allows optimization of the center imaging for large or standard size cars. This switch is accessible through the small top plate on the main chassis of the GTP4.
6. Slowly turn the "Front-Ambience knob in the clockwise direction to increase ambience. You should begin to hear slight echoes in the music and a sense of widening front sound stage in both the "Driver" and "All" modes.
7. Slowly turn the "Rear-Ambience" knob in the clockwise direction to increase rear ambience (only in systems with rear speakers). You should begin to hear an increase in echoes and a feeling of being in a vary large auditorium.

Note: The GTP4 converts the rear channels into a true rearfill surround channels which cancels all center information (vocals, horns, etc.) and lets only true stereo and ambience information come out. This same process is used in more expensive "Surround Sound" systems used in theaters.

Note: Because the rear outputs are a left minus (-) right signal you must feed test signals to the left and right inputs which are 180° out of phase (or music) to get signal from the rear outputs.

8. Adjust the front and rear ambience as desired. For optimum center imaging, it is recommended that ambience be used sparingly on the front channels.
9. To bypass the effects of the GTP4, simply pull on the "Front-Ambience" knob until it clicks to the "bypass" position. The "Enhancer On" LED on the remote control panel will turn off and your sound system should revert back to normal stereo sound without ambience.

Mechanical Exploded View

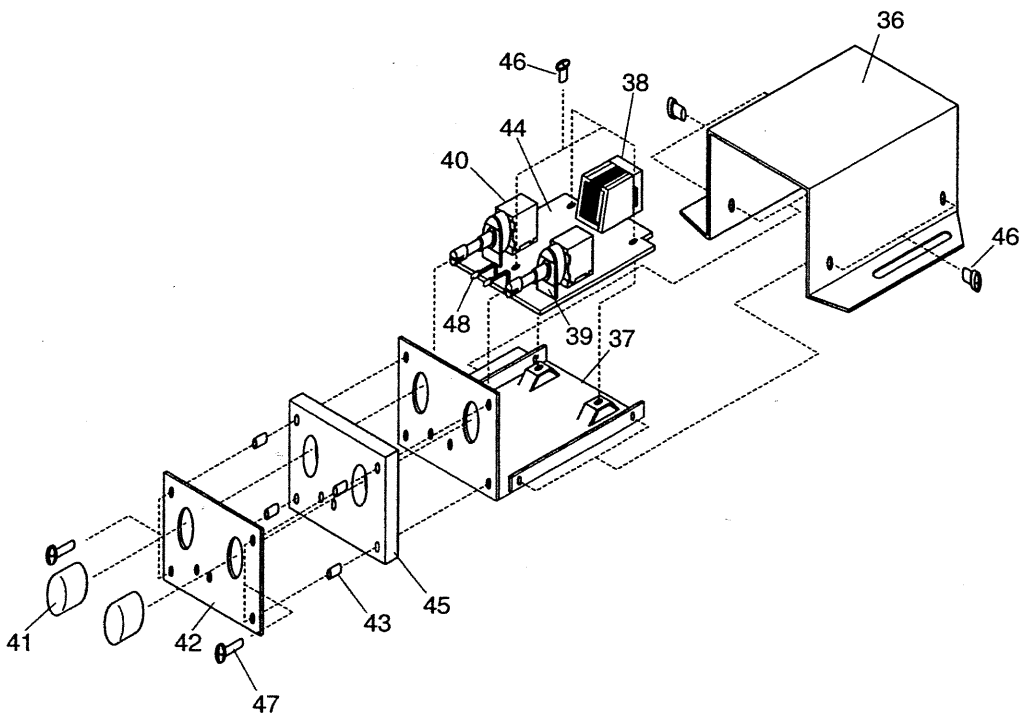


GTP4 Chassis

Ref. Number	Part Number	Description	Qnty.
Chassis			
1	5-01-084	GTP4 2288-1 TOP COVER	1
2	5-01-085	GTP4 2288-2 BOTTOM COVER	1
3	3-43-054	1835B-4 ACCESS COVER	1
4	3-43-053	1835-3 SHIELD BOX	1
5	3-61-025B	**Power Terminal Holder Assembly**	1
5-1	3-61-025	2033B-5 TERMINAL HOLDER 3P	1
5-2	1-06-016	2033-6 WIRE CON. BRACKET	1
5-3	5-01-119	2031B-7G BRASS WIRE CONN.	1
5-4	5-01-118	2018-7G BRASS WIRE CONN. G/P	2
5-5	1-33-260	M3X9 G/P BM-(BRASS W.C.)	3
Miscelaneous			
5-6		VINYL TUBE 3X1.5L	3
5-7	1-33-206	2X6 PT BZ-W.C.BKT	2
Jacks			
6	1-43-015	MODULAR JACK AP-90-6-6U	1
7	1-44-407	4 RCA JACK HSP-204V-03 GOLD	2
Fuse			
8	1-29-111	GM FUSE LAMP 3A	1
9	1-29-130	1800-F1 GM FUSE HOLDER	1
LED			
10	1-25-011	TRIANGLE LED RED5x4mmL-323HD	1
Switches			
11	1-27-037	SL.SW. 1P2T SS-12D05G5-Y-00	1
12	5-01-092	BRASS TUBE 4X2.6X21mm HEXGON	4
Connectors			
13	1-58-004	CONNECTOR 8POLE1 MOLEX#5569-08A1	1
Screws and Washers			
14	1-33-251	3X0.5X5 (2.6) BM NI	8
15	1-33-252	3X8 (2.6) BT NI (BH)	2
16	1-33-256	3X0.5X5 BM NI	4
17	1-34-269	2.6X8 BT NI	2
18	1-34-285	2.6X6 KM NI D=5 (FM0.45) FH	12
19	1-35-379	3X0.5X16 BM NI	2
20	1-37-130	M3 NUT	2
21	1-37-230	M3 SPRING WASHER BZ	2
Paper			
22	1-40-052	FIBRE PAPER 120X120X0.5mm	1
23	1-40-053	FIBRE PAPER 80X20X0.3mm	1
Wafer			
24	1-58-008	WAFER 2 PINS S11-2W	1
25	9-01-031	LED PCB-4 (PCB GTE422-3)	1
Housing			
	1-51-237	UL2854 #32 SHIELD WIRE HARNESS SV2.5-4H/S11-5H 120mm	
Harnesses			
	1-51-301	HARNESS UL1007 #26 HOUSING SV2.5-3H TO S11-3H 120mm BLUE 120mm RED 120mm BLACK 120mm	1
	1-51-239	UL1007 #26 WIRE w/S11-2H HARNESS RED 100m BLACK 100mm	1

Remote Control Chassis

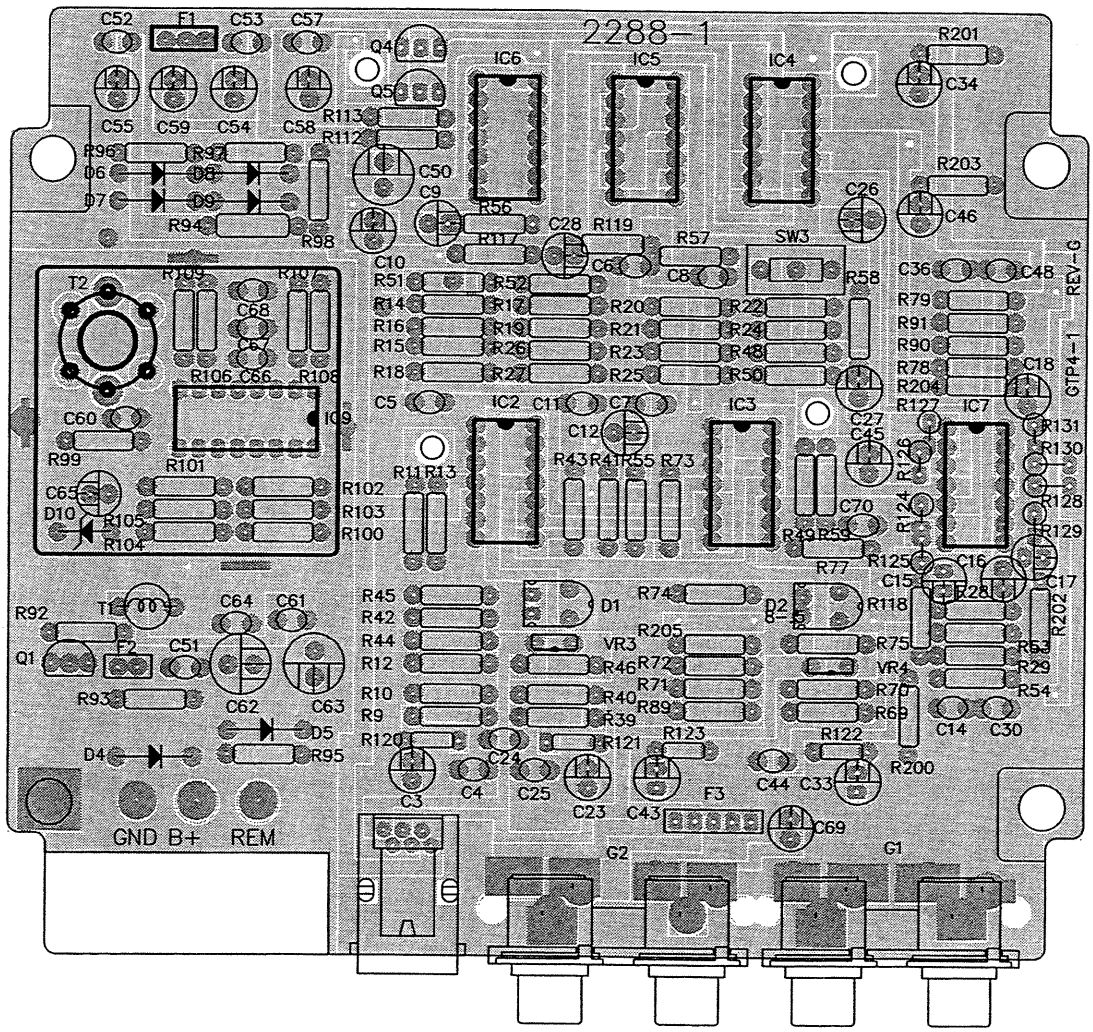
Ref. Number	Part Number	Description	Qnty.
Resistor			
R 114, 115	1-18-315	1/4W+-5% PS 1.5K OHM	2
R 116	1-18-347	1/4W+-5% PS 4.7K OHM	1
Chassis			
36	5-01-086	2288-3 VR TOP COVER	1
37	5-01-087	2288-4 VR BOTTOM COVER	1
Jacks			
38	1-43-015	MODULAR JACK AP-90-6-6U	1
Potentiometers			
39	1-26-098	V16L4(7x6.5) (PH2D)S(SL123-3) 20KC-15A10K (18TEETH) "NOBLE"	1
40	1-26-093	V16L4(7X6.5)(PH2D)S(SL123-4) 20KC-15A10K (18TEETH) "NOBLE"	1
Knob			
41	3-64-003	KNOB 2111-3 FADER KNOB	2
42	5-01-083	2288-5 PANEL PLATE	1
43	5-01-091	BRASS BUSHING 5X3X6mm	4
PCB			
44	9-01-034	VR PCB GTP4-2	1
45	1-42-108	2288-5A RUBBER PAD 55X32X6mm	1
46	1-33-254	3X0.5X4 PM BZ	7
47	1-33-415	3X0.5X10 PM BZ	4
LED			
48	1-25-010	GREEN LED L-34GD 3MM	2



Printed Circuit Boards (TOP SIDE)

This board is viewed from the top.

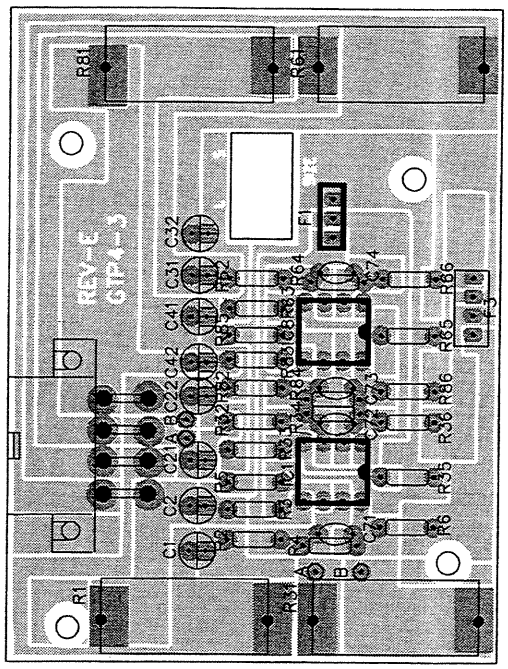
GTP4-1 Rev-G



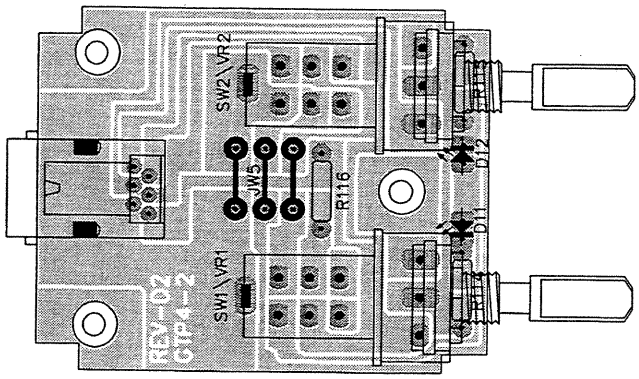
Printed Circuit Boards (BOTTOM SIDE)

These boards are viewed from the bottom looking through the board to see the components and reference designators.

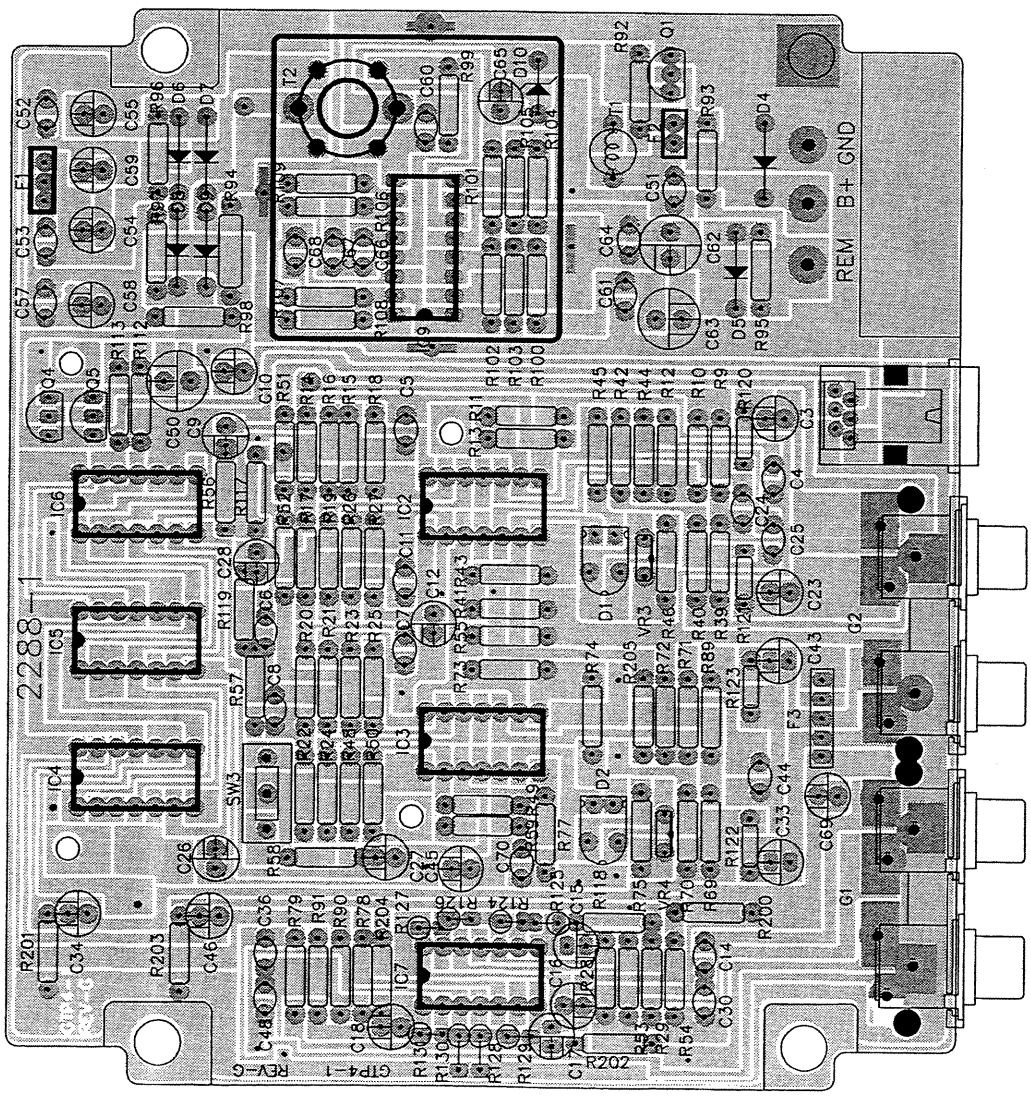
GTP4-3 Rev-E



GTP4-2 Rev-D2



GTP4-1 Rev-G



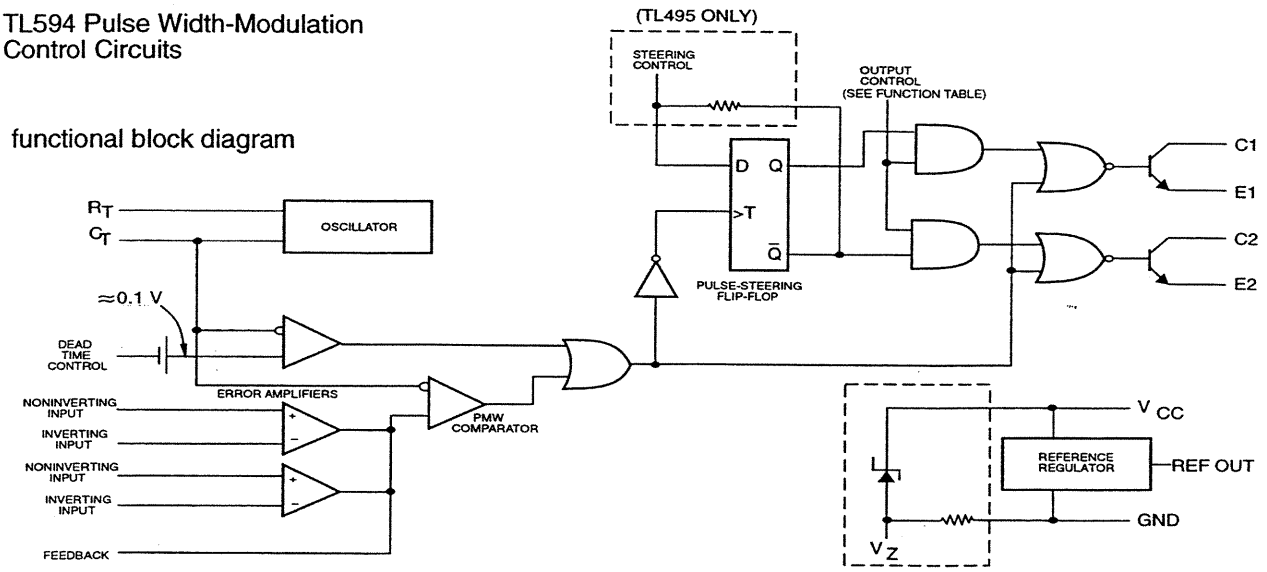
Electrical Parts List

Ref. Number	Part Number	Description	Qnty.
MAIN PRINTED CIRCUIT BOARD			
Transformer			
T2	1-01-204G	TOROID XJ-41306-TC #113 P=0.6mm 7TX2 S=0.4mm 5TX2	1
Chokes			
T1	1-01-205G	CHC IRON POWER CORE T80-26 #2730HG/0.6 X 170T 1.2mH 600uH	1
Opto Couplers			
	1-03-301	OPTHO COUPLER NSL-32H-001	2
Diodes			
D 4	1-05-001	IN4001	1
D 5	1-05-009	IN4148	1
D 6,7,8,9	1-05-022	FAST RECOVERY FR152	4
Zener Diode			
D 10	1-06-005	ZEN 1/2W+-5% 15V	1
Transistors			
Q 1	1-07-003	TRA 9013H	1
Q 4,5	1-07-004	9014C	2
Integrated Circuits			
IC 4, 5, 6	1-09-305	4066BE	3
IC 2, 3, 7	1-09-408	LF347	3
IC 9	1-09-418	TL594CN	1
Mylar Capacitors			
C 14, 30, 36, 48, 51, 64, 68	1-10201RH	M.CAP100V+-10% 0.01UF	7
C 66, 67	1-10301RH	100V+-10% 0.001UF	2
C 70	1-10415PH	100V+-10% 0.0015UF	1
C 44	1-10315RH	100V+-10% 0.015UF	1
C 4, 24, 60	1-10447RH	100V+-10% 0.0047UF	3
Electrolitic Capacitors			
C 3, 23, 33, 43	1-12010PI	E.CAP 50V+-20% 1UF 5X11	4
C 65	1-12133LI	16V+-20% 33UF 6X11	1
C 54, 55, 58, 59	1-12210LI	16V+-20% 100UF 6X1	4
C 50	1-12247NI	35V+-20% 470UF 12X2	1
C 62, 63	1-12210NI	35V+-20% 100UF 8x12	2
C 9, 10, 12, 15, 16, 17, 18, 26, 27, 28, 34, 45, 46, 69	1-13110LI	16V+-20% 10UF 4X7.5 MINI	14
Monolythic Capacitors			
C 5, 6, 7, 8, 52, 53, 57, 61	1-14091PH	50V+-10% 0.1UF (EC05ZD104KHB)	8
C 11	1-14103PH	50V+-10% 33PF HB	1
C 25	1-14101PH	50V+-10% 330PF HB	1
Resistors			
R 104,105	1-18-010	1/4W+-5% PS 1 OHM	2
R 95, 96, 97	1-18-110	1/4W+-5% PS 10 OHM	3
R 29, 54, 79, 91	1-18-210	1/4W+-5% PS 100 OHM	4
R 92, 101	1-18-310	1/4W+-5% PS 1K OHM	2
R 46, 75	1-18-322	1/4W+-5% PS 2.2K OHM	2
R 14,16, 20, 21	1-18-339	1/4W+-5% PS 3.9K OHM	4
R 45	1-18-343	1/4W+-5% PS 4.3K OHM	1
R 74, 106	1-18-347	1/4W+-5% PS 4.7K OHM	2
R 102	1-18-362	1/4W+-5% PS 6.2K OHM	1
R 9,13, 39, 43, 69, 89, 108	1-18-410	1/4W+-5% PS 10K OHM	7
R 103	1-18-412	1/4W+-5% PS 12K OHM	1
R 77	1-18-415	1/4W+-5% PS 15K OHM	1
R 100	1-18-422	1/4W+-5% PS 22K OHM	1
R 11, 41	1-18-430	1/4W+-5% PS 30K OHM	2
R 18, 19	1-18-443	1/4W+-5% PS 43K OHM	2
R 107,109	1-18-447	1/4W+-5% PS 47K OHM	2
R 205	1-18-475	1/4W+-5% PS 75K OHM	1
R 15, 17, 22, 23, 24, 25, 27, 28, 50, 53, 55, 56, 57, 58, 59, 70 71, 72, 73, 78, 90, 93, 98, 112 113, 117, 118, 119, 200, 201, 202, 203, 204	1-18-510	1/4W+-5% PS 100K OHM	33
R 44	1-18-515	1/4W+-5% PS 150K OHM	1
R 10, 40	1-18-522	1/4W+-5% PS 220K OHM	2
R 12, 42, 49	1-18-547	1/4W+-5% PS 470K OHM	3
R 26	1-18-551	1/4W+-5% PS 510K OHM	1
R 48	1-18-610	1/4W+-5% PS 1M OHM	1
R 51, 52	1-18-634	1/4W+-5% PS 10M OHM	2
R 99	1-19-210	1/2W+-5% PS 100 OHM	1
R 94	1-20-210	1W+-5% PS 100 OHM	1
R 120, 121, 122, 123, 124, 126, 128, 130	1-17-410	1/8W+-5% PS 10K OHM	8
R 125,127,129,131	1-17-412	1/8W+-5% PS 12K OHM	4
VR 3, 4		SEMIFIXED 50K OHM	2
	9-01-032	PCB MAIN PCB GTP4-1	1
INPUT CIRCUIT BOARD			
Integrated Circuits			
IC 1, 8	1-09-022	LM833	2
Electrolytic Capacitors			
C 1, 2, 21, 22, 31, 32, 41, 42	1-13110LI	E.CAP16V+-20% 10UF 4X7.5 MINI	8
Ceramic Capacitors			
C 71,72, 73, 74	1-16047PH	50V+-10% 47PF	4
Resistors			
R 6, 36, 66, 86	1-17-410	1/8w+-5% PS 10K OHM	4
R 4, 5, 34, 35 64, 65, 84, 85	1-30-432	1/8w+ -1% PS 33.2K OHM	8
R 2, 3, 32, 33, 62, 63, 82, 83	1-30-510	1/8W+ -1% PS 100K OHM	8
R 1, 31, 61, 81	1-23-115	5W+-5% WW/CEMENTP 15 OHM	4
PCB			
	9-01-033	LOz PCB GTP4-3	1
Wire			
	UL1007	#26 TOP-COAT S/W RED 65mm(10+10)	2
REMOTE CONTROL CIRCUIT BOARD			
Resistors			
R 114,115	1-18- 315	1/4w+-5% PS 1.5K OHM	2
R 116	1-18- 347	1/4w+-5% PS 4.7K OHM	1
LED			
D 11, 12	1-25-010	LED GREEN LED L-34GD 3mm	2
Potentiometer/Switch			
	1-26-098	V16L4(7X6.5)(PH2D)S(SL123-3) 20KC-15A10K(18TEETH)"NOBLE"	1
	1-26-093	V16L4(7x6.5)(PH2D)S(SL123-4) 20KC-15A10K (18TEETH)"NOBLE"	1
	1-33- 254	M3X0.5X4 PM BZ	7

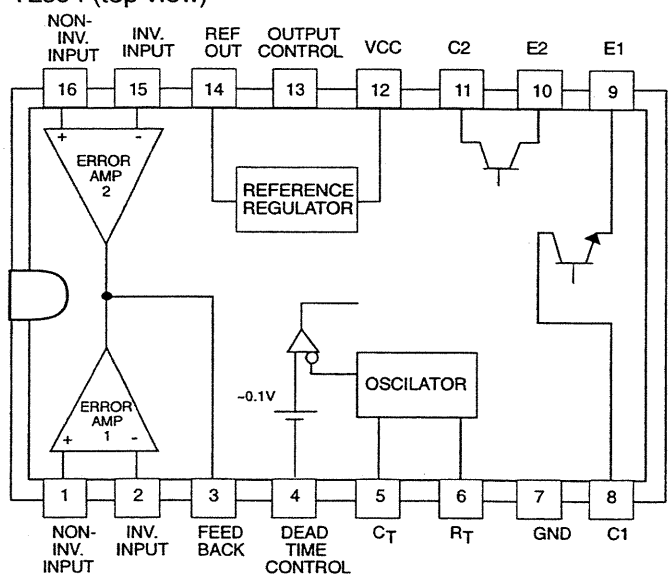
Integrated Circuit Layout and Voltages

TL594 Pulse Width-Modulation Control Circuits

functional block diagram



TL594 (top view)



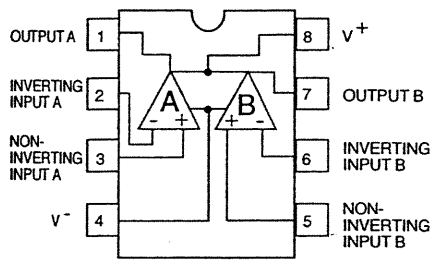
I C: 9 (TL 594)

PIN	VOLTAGE	
8	8.6 V	pulse train with 14.4 V peaks
11	10.3 V	
12	14.4 V DC	

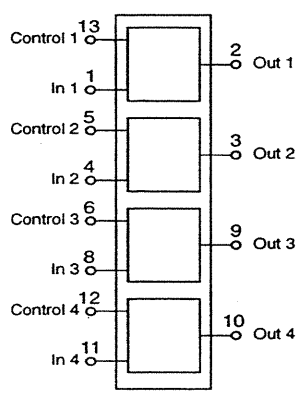
I C: 1, 8 (LM833)

PIN	VOLTAGE
4	-7 V DC
8	+7 V DC

LM833 top view



4066 CMOS Switch Block Diagram

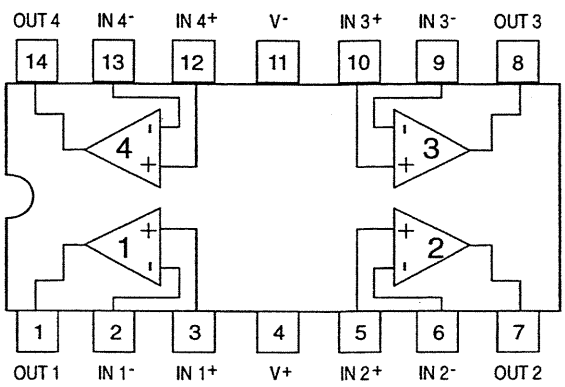


IC: 4, 5, 6

V_{DD} = Pin 14 = 7V

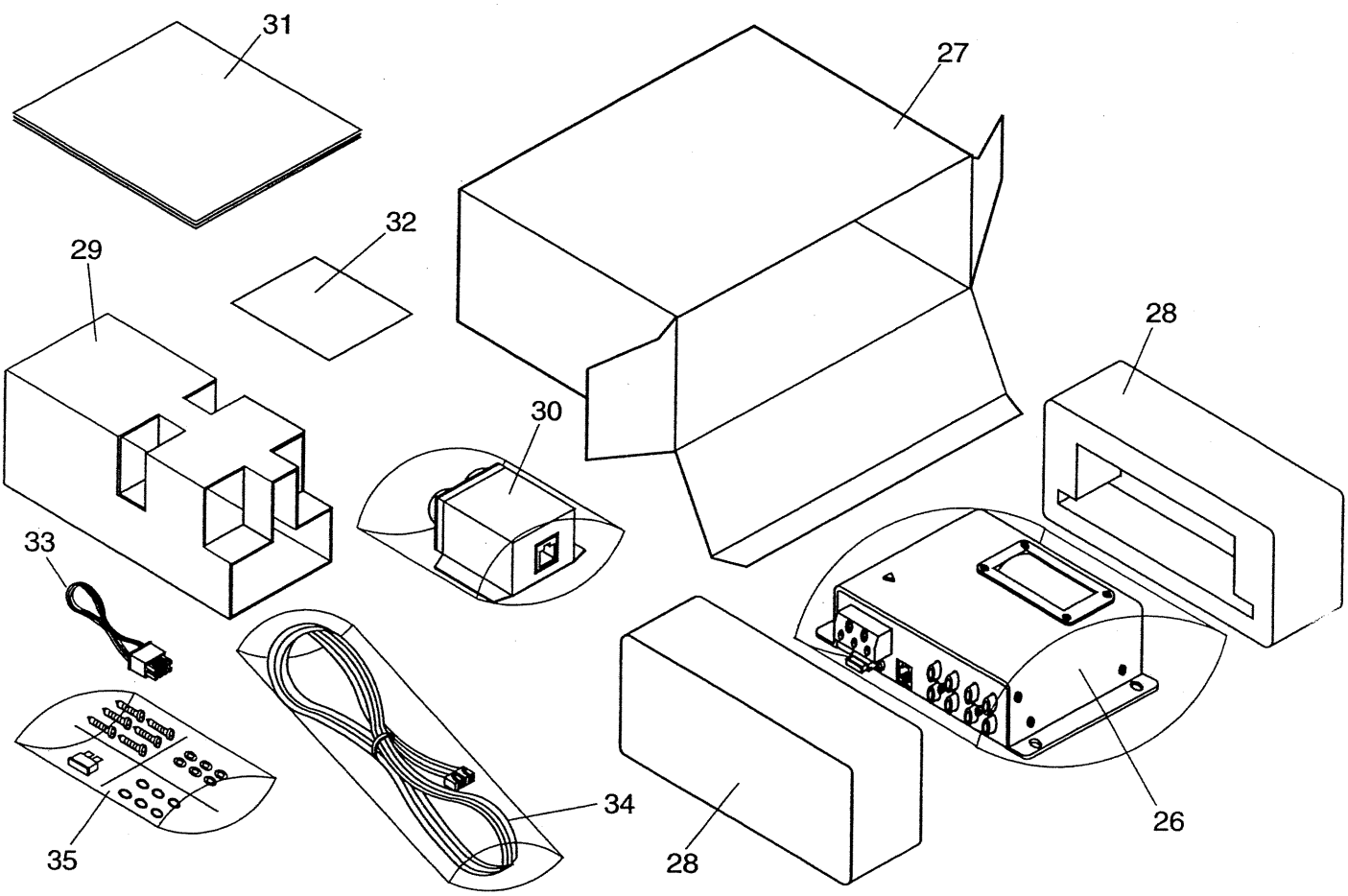
V_{SS} = Pin 7 = -7V

LM347 (top view)



Packaging Parts List

Part Number	Reference Number		Description	Quantity
Large Items				
02-2288-1A	26		GTP4 UNIT	1
01-2288-1	27		GIFT BOX GTP4 2288-P4	1
01-2288-2	28		INNER PAD 2288 P2	2
1835-F	29		1835 POLYFOAM	1
02-2288-2A	30		REMOTE CONTROL BOX	1
01-2288-3	31		MANUAL	1
01-2288-3	32		WARRANTY CARD JBL	1
Harness				
1-50-047	33		MOLEX 8POLE #3901-01-2080	1
		set	12X0.193X1.5X2C TWIN WIRE	
			PURPLE/PURPLE-BLK 330mm	
			GREY/GREY-BLK 330mm	
			GREEN/GREEN-BLK 330mm	
			WHITE/WHITE-BLK 330mm	
1-51-117	34		6U PHONE CABLE 20ft w/PLUG x2	1
Fuse				
1-29-111	35		GM FUSE LAMP 3A	1
1-36-432			4X25 PA BZ	4
1-37-140			M4 FLAT WASHER BZ	4
1-37-240			M4 SPRING WASHER BZ	4



Schematic Wiring Diagram